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ABSTRACT

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INSTRUCTION AND THE EFFECTS OF SCHOOLING

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ABSTRACT

This paper argues that research on school effects has come to regard instruction as the core of the schooling process. The paper adopts an organizational view of schools which suggests that instruction is the school's "core technology," occurring when teachers apply available resources such as time and curricular materials to the exigencies of classroom life. Two aspects of instruction, the use of time and the coverage of curricular content, are discussed in detail. But the paper also acknowledges that instruction occurs in a social context, which must be specified if one wishes to analyze schooling rather than pedagogy. Finally, an empirical example is presented to illustrate the formulation and to suggest further ways of measuring instruction.

INSTRUCTION AND THE EFFECTS OF SCHOOLING

Twenty years ago, researchers who wanted to know how schools influenced student achievement asked a question of this sort: "What is it about some schools that allows their students to score higher on achievement tests than students in other schools?" (e.g., Coleman et al., 1966; for a review see Averch et al., 1972). As is well known, the answer they uncovered was essentially, "not much," and obituaries were written for the study of school effects (e.g., Hauser, 1969). But instead of passing away, research on the topic has been invigorated in recent years with a number of important conceptual advances.

The insight that permitted such progress was the realization that achievement differences between students might be explained by within-school variation in their experiences. The research question changed to, "What happens to some students that allows them to achieve more than others, in their own and in other schools?" And in contrast to the negative findings of earlier research, scholars pursuing this question have successfully revealed some school conditions and processes that make a difference for student achievement (Summers and Wolfe, 1974, 1979; Brown and Saks, 1975; Murnane, 1975; Barr and Dreeben, 1983; Rowan and Miracle, 1983; Dreeben and Gamoran, 1986; Gamoran, 1986, 1987; Dreeben and Barr, forthcoming; see Heyns, 1986, for a review).

In this paper I argue that the most important within-school difference in student experiences is variation in the instruction provided by teachers. I discuss in detail two aspects of instruction, time and the coverage of curricular content, stressing their conceptual and methodological difficulties and advantages. As Kilgore (1986) has recently warned, writers who leap to consider instruction as the savior of school effects research may neglect the other sociological insights gathered during the past twenty years. I address this problem by placing instruction in a social context. Finally, I provide an empirical illustration of this perspective.

Instruction and Student Achievement

Instruction has come to the forefront of research on school effects from a variety of sources. First, when it became clear that within-school variation in student achievement was far greater than variation between schools (e.g., Jencks et al., 1972), it made sense to look at potential sources of educational effects inside schools. For example, whereas Coleman et al.'s (1966) landmark study had examined the effects of the average verbal ability of teachers in a school, Murnane (1975) assessed the verbal skills of each student's teacher, linking students to their teachers in his analysis. Similarly, Summers and Wolfe (1974, 1977) and Brown and Saks (1975) studied classroom-level effects on achievement rather than the influence of average school conditions.

Second, the incorporation of instruction into sociological models follows a long tradition of research on "effective teaching" in the educational literature (e.g., Barr, 1929, 1948; Ryans, 1960; Flanders, 1970; Dunkin and Biddle, 1974; Doyle, 1977). These works attempted to link the characteristics and behavior of teachers with student outcomes. Most prominently the "process-product paradigm" (Dunkin and Biddle, 1974) views achievement as the result of student inputs and a process exerted by teachers. As Barr and Dreeben (1983) have pointed out, this literature is unsupported by theory; studies "lack substantive formulations about what instruction is and how it works" (1983:29). But its emphasis on classroom events has helped direct the attention of sociologists toward within-school processes that may produce achievement. Whereas Summers and Wolfe (1974, 1977), Murnane (1975), and Brown and Saks (1975) had improved on prior research by examining classroom conditions instead of average school characteristics, subsequent researchers went a step farther by considering classroom processes as well (Barr and Dreeben, 1983: Rowan and Miracle, 1983; Dreeben and Gamoran, 1986; Gamoran, 1986).

..ird, sociologists have recently recognized "opportunity to learn" as a key aspect of the schooling process (Sørensen and Hallinan, 1977, 1986; Heyns, 1978; Gamoran, 1987). In this view students' learning is constrained by the curriculum and instruction to which they are exposed. This tradition emphasizes the amount of time students spend learning. It has been traced to Carroll's (1963) "model of school learning," which included instructional time, student effort, and quality of teaching as predictors of student achievement. Opportunity to learn may also include the coverage of instructional content, suggesting that teachers who cover more material or a more rigorous curriculum are likely to produce higher achievement, other things being equal (Barr and Dreeben, 1983; Gamoran, 1986).

Fourth, an organizational perspective on school effects points toward studying instruction as the source of achievement variation. Parsons (1960) noted that the technical level of organization in schools consists of "the conduct of classes by the teacher" (1960:60). School effects researchers consider achievement as the "product" of schools, so it seems appropriate to examine the technology that produces it. As developed by Barr and Dreeben (1983; see further Dreeben and Gamoran, 1986; Gamoran and Dreeben, 1986; Dreeben and Barr, forthcoming), the technology of schools takes place when school districts and schools provide resources to teachers who use them in classrooms. Chief among these resources are time, curricular materials, and the competencies of teachers and students. Gamoran and Dreeben (1986), for instance, found that teachers introduced more new words to first graders when provided with more time to teach, more challenging materials, and more able students. The more words covered, the more students were able to read by the end of the year. Gamoran and Dreeben argued that learning is produced through a technical process of allocating and using resources.

By focusing on instruction as an essential tool in the shaping of achievement, sociologists have moved from studying the effects of schools (the organizations in which learning takes place) to the effects of schooling (the technological processes that produce learning; see Bidwell and Kasarda, 1980; Gamoran, 1987). Although time and content coverage are by no means the only aspects of instruction that influence learning, they are the most common and so far the most successful ones to be included in sociological models of achievement. For this reason they deserve special attention. I will discuss problems of operationalization and of measurement for each of them.

Instructional Time

Following the educational writings of Carroll (1963), Bloom (1976), and Denham and Lieberman (1980), sociologists began to take note of instructional time as a predictor of learning. The relation seems obvious in retrospect: the more time teachers spend teaching and students spend learning, the higher student achievement. But there are a number of difficulties with this simple formulation. These problems involve selecting and measuring an appropriate indicator.

Some researchers conceive of time as the amount students spend in school. Wiley and Harnischfeger (1974) measured time as the number of days in a year students attended. Heyns (1978) showed that students learn more during the school year than in the summer, and Alexander, Natriello and Pallas (1985) reported that high school dropouts gain less on achievement tests than students who remain in school. Each of these studies uncovered positive effects of time spent in school on achievement. At the same time, they ignored the possibility that what matters is not so much how much time students spend in school, but how they spend their time while there. For example, in finding higher achievement among non-dropouts than dropouts, Alexander, Natriello, and Pallas neglected to examine differences in the school experiences of non-dropouts. But using the same data I found that achievement differences between students in academic and non-academic curricular programs were often twice as great as the gap between non-academic students and dropouts

(Gamoran, 1987). I argued that where one is in school matters more for the development of cognitive skills than simply whether one is in school or not.

A second indicator is how much time teachers spend teaching. Much of teachers' time is usurped by noninstructional matters such as procedural concerns and managing discipline problems. Teachers who are able to minimize these distractions may produce higher achievement (Gamoran and Dreeben, 1986; Dreeben and Barr, forthcoming). In addition, some teachers have more time at their disposal as a result of district and school differences in scheduling (Barr and Dreeben, 1983; Gamoran and Dreeben, 1986). Accordingly, time may be indicated by the amount of time teachers give to particular subjects, and by the proportion of that time actually spent on instructional matters. Both may vary within and between schools, and the second is an especially likely candidate for within-school variation.

It is unclear whether teacher reports of time allocations provide adequate data, or whether observation is necessary. The former is obviously easier and less expensive to gather, but its reliability is questionable. Oakes (1985) compared the two, finding teacher reports of the proportion of time spent on instruction to be fairly close to observers' estimates. In an initial study using teacher reports of classroom time, Barr and Dreeben (1983) did not find significant effects on content coverage or on achievement. But with data gathered subsequently that included observational measures, they discovered large time effects on content coverage (Barr, 1983; Dreeben and Gamoran, 1986) and smaller but noteworthy effects on learning when content coverage was held constant (Dreeben and

Gamoran, 1986; Dreeben and Barr, forthcoming; Gamoran and Dreeben, 1986). The varied findings may indicate that observation of time usage is necessary to obtain data that is precise enough to yield significant results. Given the expense of observational data and the virtual impossibility of gathering it in a very large sample, work is urgently needed to assess the reliability of teacher-reported time data.

A third variety of indicator assumes that what matters is not what teachers are doing, but how students are responding. Students who spend more time actively engaged with their work are likely to learn more, other things being equal. Of all the time indicators, this variable--known as "time-on-task" or "engaged time"--is the hardest to measure. In the influential Beginning Teacher Evaluation Study (BTES) (Denham and Lieberman, 1980), researchers measured time-on-task by observing selected students at four-minute intervals, noting whether or not they appeared to be attentive. Other studies have observed students at more rapid intervals (e.g., Karweit and Slavin, 1981). But as Karweit (1983) pointed out, time-on-task is probably highly variable for any given student, depending on the time of day, the format of instruction, the particular topic at hand, and other aspects of classroom life that change rapidly. This variability makes it difficult to have confidence in time-on-task measures as reliable indicators of how students spend their day. Moreover, stressing the importance of engaged time leaves open the question of what material students are engaged in learning. As Karweit noted, "paying attention to a poorly organized, or incorrect exposition on a topic obviously does not affect learning in the same way as paying attention to an excellent lecture" (1983:41-42).

Content Coverage

One thing teachers do with time is proceed through the curriculum. The coverage of instructional content, or "content coverage," is associated with achievement because the more academic material teachers cover, the more students learn (Dahllof, 1971; Barr, 1973-74, 1983). Coverage is usually measured with respect to a particular curriculum. For example, Rowan and Miracle assessed the impact of the number of reading levels covered during fourth grade on students' standardized test scores. Similarly, Barr (1973-74), Barr and Dreeben (1983), and Gamoran (1986) measured content coverage as the number of words introduced during first grade. The words were contained in basal readers provided by the district or school. Effects on learning in the latter studies were much larger than in Rowan and Miracle's because learning was measured with a test derived from the curriculum that had been covered.

Measuring content coverage is at least as difficult as gauging time, but for different reasons. The problem is not one of needing classroom observation, because so much of classroom instruction is driven by the use of textbooks and other written materials. One can estimate coverage by finding out what portions of the materials were taught in class. The problem with content coverage is identifying a reasonable universe from which the content in particular classes can be scored. For example, suppose one wished to assess content coverage in ninth grade social studies. Some classes cover history, others geography, and others world civilizations. How is one to measure such disparate instruction on a common scale? And what kind of test would be reasonable for estimating the effects of such coverage?

Studies that have used content coverage successfully tended to be narrowly focused on more specific objectives. Barr and Dreeben (1983) and Gamoran (1986) added up the number of words first graders were taught. Because individual words served as the central instructional units for all reading groups, it was reasonable to count them as measures of content coverage. But in higher grades the unit of instruction becomes much more ambiguous. Rowan and Miracle (1983) solved the problem by summing the number of levels in the reading series covered during fourth grade. This approach succeeded because all the classes in their sample used a single curricular program. Had they considered a wider sample, Rowan and Miracle would not have been able to maintain their unit of coverage.

At the high school level, some studies have used the number and type of academic courses in which students enrolled as measures of exposure to instruction (Alexander and Cook, 1982; Alexander and Pallas, 1984; Gamoran, 1987). This indicator essentially proxies for content coverage under the assumption that students in different classes cover different material. For example, these authors assume that students who enroll in more math courses cover more academic material in math. While this proxy is better than nothing, there are two problems with it. First, it is at best a crude indicator of instruction; it says little about what actually happens inside classrooms. Second, although it appears useful in mathematics and science, where there is a common and distinct sequence of courses, it is less useful in subjects such as English and social studies where courses are less easily distinguished by their titles and where nearly all students take the same number of courses (Gamoran, 1987).

An adequate indicator of content coverage must reflect the full variety of material presented in all the classes in the sample. In addition, if coverage is to predict achievement, it needs to be closely tied to the outcome measure. This means not only that the test items should be related to what occurred in class, but that the material covered in all sample classes be included on the test in comparable ways (Harnischfeger and Wiley, 1981). This linkage increases the chances of detecting schooling effects. It is not an artificial means of increasing the relation between schooling and learning, as some have suggested (Rowan, 1985). Instead, it reflects a substantive concern with assessing schooling effects where they actually occur.

Some scholars have objected to the measurement of content coverage and the use of related achievement tests. The relation seems trivial to them; obviously the more content covered the more students will learn. It is true that coverage--as well as time--are preconditions for learning. School learning could not take place in their absence. But beyond that logical connection, the relation is not trivial at all, because there are important differences between and within schools in how much content is covered and in how much of the material particular students master (Dreeben and Gamoran, 1986).

Why does instruction vary between classes, and why do students differ in their rates of success? This is a sociological question, not merely a matter of pedagogy, because the social context of instruction plays a crucial role in the relation between teaching and learning. Although instructional variables appear to be at the center of schooling effects, sociological investigations must not be restricted to them. Two decades of research on school achievement have suggested numerous conditions that influence the provision of instruction as well as its mastery by students.

The Social Context of Schooling

An organizational view of school systems reveals both the centrality of instruction and the importance of its social context. This perspective suggests that schools are organized around a central goal of producing change in students' competencies. Two sorts of competencies are stressed: values, norms, and behavior; and technical knowledge such as cognitive and vocational skills. The former represent the latent, or "hidden" curriculum of schools, the latter the school's manifest goal. Consequently, the school's stated purpose is to provide instruction to students. As is widely known now, schools do not organize around their goal in the ways that government bureaucracies or private firms do (Weick, 1976). Their technical work is performed by specialists who are spatially isolated and rarely supervised. Nevertheless, instruction lies at the core of school systems, constituting the technical process through which learning gets produced (Gamoran and Dreeben, 1986). One who wishes to discover why some students learn more than others must examine variation in this technical process.

Despite efforts to shield it from the outside world, no organizational technology exists in a vacuum (Thompson, 1967). On the contrary, the operation and success of school system technology depends on a host of factors related to the general and specific contexts in which it is found. Figure 1 displays the location of instruction within these contexts.

Figure 1 about here.

Institutional, Community, and School Contexts

First of all, Meyer (1977, 1980) has described the irstitutional setting in which American schools operate. This institutional context conveys a system of beliefs and values about education that influence the structure and operation of school systems throughout the country. For example, Meyer and Rowan (1978) argued tnat the structural similarity of American elementary schools results from an institutionalized belief in the legitimacy of the conventional arrangement.

To a certain extent, all American schools are embedded within the same institutional context (Meyer, 1977; Rubinson, 1986). But some differences between schools do exist; for example, elite private schools appear to have a distinct "charter," or mission, that sets them apart from other schools and that may influence their structure and processes and, ultimately, student outcomes (Cookson and Persell, 1985). Similarly, within-school differences in widely recognized categories may reflect institionalized beliefs about what can be expected from different kinds of students. Labels such as "vocational track," and "college-prep program" are likely to influence what occurs in classrooms.

Early sociological research on education stressed the importance of the school's community context (e.g., Waller, 1932; Hollingshead, 1949). This tradition was recently revived by Coleman and Hoffer (1987), who argued that the heterogeneous communities of contemporary America typically fail to provide a network of relationships that support academic success. Despite the limitations of geographic communities, Coleman and Hoffer suggested that some schools are surrounded by "functional communities" that provide the necessary support. Religious private schools are the prime example of such functional communities. Their normative environment enables them to maintain an orderly climate and a high level of academic demands. In this way the community context influences instruction and achievement.

Institutional and community effects occur in part by influencing conditions at the school level. Most of the research on contextual effects has in fact examined school characteristics. As I noted at the outset, the average level of resources in a school--per pupil expenditures, number of books in the school library, and so on--has little impact on individual achievement (e.g., Coleman et al., 1966; see also Gamoran, 1987). School composition variables, such as the demographic characteristics of the student population, also appear weakly related to outcomes when individual characteristics are taken into account (Gamoran, 1987). By contrast, school policies may make a greater difference for teaching and learning. Decisions on the availability of academic programs, curricular materials, and instructional time constrain the experiences of teachers and students (Gamoran and Dreeben, 1986; Gamoran, 1987). Staff development and other school-wide attempts at instructional support may also enhance the context in which instruction takes place (for a review, see Mackenzie, 1983).

While important, these school and extra-school contexts are limited for two reasons. First, their effects must be relatively small, because student achievement does not vary much from school to school, relative to within-school differences. Second, their effects are most likely to occur indirectly, by influencing classroom conditions. For example, communities and schools that support academic rigor may be effective because they permit teachers to assign more homework and encourage students to enroll in more academic courses (Coleman and Hoffer, 1987). For these reasons, the largest effects on instruction and achievement are likely to be found within the classroom, the school's "technical core."

Classroom Context

Schooling is a collective phenomenon. It involves decisions made by teachers with respect to a given set of resources, a particular group of students, and some social designations (e.g., a "remedial" class, a "college-track" class) relating to the class in question. It is important to stress the fact that teachers invariably make decisions with collections of students in mind, rather than with respect to each student individually (Barr and Dreeben, 1983; Gamoran, 1985). Thus the collective character of the class can be expected to have important bearing on instruction, and on the relation between instruction and learning.

Teachers carry out their work within the bounds of constraints fostered by the allocation of resources from higher levels of school system organization (Gamoran and Dreeben, 1987). District and school personnel make decisions about the provision of time--such as the length of the school year, the school day, and class periods--

and about the allocation of curricular materials. Given these constraints, teachers have considerable latitude, making their own decisions about how these resources are to be applied on a day-to-day basis. What considerations guide their decisions?

Foremost among the teacher's concerns are numerous aspects of class composition--the quality of the "raw materials" at hand. Classes with more able students presumably allow teachers to advance farther in the available curriculum. A larger and more diverse class may move more slowly, and may also require more time for procedures and management, taking away from instructional time. The level of enthusiasm and effort in the class will also affect the teacher's ability to cover content and to use time efficiently. Accordingly, these class characteristics may be expected to influence instruction and, indirectly, achievement.

Holding constant the class achievement level, the social ranking of the class may exert direct effects both on instruction and on student responses to instruction. Classes that are ranked low relative to others in the school, especially if they bear stigmatizing labels such as "remedial" or "basic," may influence teachers to slow down instruction even further than their achievement level would call for (Gamoran, 1985). Moreover, students in such classes may reduce their efforts as a consequence of lowered self-esteem and negative attitudes towards school (Heathers, 1969). At the same time, high-ability classes may move speedily, and their students may find extra incentive for learning. I tested these hypotheses with data from a sample of first graders, finding that while the relative rank of within-class ability groups influenced the provision of instruction, it did not affect learning once instruction was taken into account (Gamoran, 1985, 1986). However with older children, who might be more aware of their rankings, there is more reason to expect net effects on learning.

In addition to these class characteristics, the teacher brings some personal attributes that have bearing on instruction and on the link between instruction and learning. Among these are experience, expectations, preferences and skills. These conditions become part of the collective character of schooling because as I noted earlier, they are applied to the class as a whole (or perhaps to small subgroups) rather then to students individually.

Individual Context

Each student perceives schooling as a both an individual and a collective experience. The personal characteristics students bring with them to school influence achievement. It is well known, for example, that the best predictor of subsequent achievement is prior achievement (Lavin, 1965). Also, the amount of effort students expend is sure to influence how much of the curricular content they master (Carroll, 1963; Sørensen and Hallinan, 1977, 1986).

The lasting contribution of school effects research is the evidence it has provided for the important impact of students' ascribed characteristics on their achievement. Student socio-economic status and racial and ethnic origins have pervasive influences on school outcomes (e.g., Coleman et. al, 1966, Jencks et al., 1972). But the operation of these effects is not as simple and direct as was once thought. Recent work suggests that background effects do not occur as a constant, cumulative influence on achievement, despite the fact that racial, ethnic, and socioeconomic differences widen as children proceed through the school system. At the elementary level, Heyns' (1978) work showed that schooling affects black and white, poor and non-poor children similarly. It is during the summer, in the absence of schooling, that students from advantaged economic circumstances make greater progress in achievement. Also, studies by Barr and Dreeben (1983), Gamoran (1984), and Dreeben and Gamoran (1986) suggested that race and SES have little direct influence on first grade learning once instructional differences have been taken into account. In high schools, recent work pointed to differences in curricular programs, dropout rates, and coursework as the mechanisms through which socioeconomic effects were transmitted (Gamoran, 1987). In other words, SES was associated with achievement, but the effect occurred through an influence of SES on school experiences. Race and ethnicity effects, though, did not occur in the same way. Thus the direct contribution of social origins to achievement is very much in question.

In summary, I view instruction as the core of schooling, embedded in a set of organizational constraints (primarily the availability of time and materials), class characteristics, social designations, and teacher and student attributes. The classroom social organization is surrounded by an environment that includes institutional, community, and school influences. With this conceptual framework in mind, we are prepared to address the question of why some students learn more than others.

Data

No existing data set contains information on all the settings I have described. To illustrate this conceptual formulation, I have chosen one with rich data on classroom conditions and an innovative measure of instruction. The analysis will include the central aspects of Figure 1: achievement, instruction, and their classroom and individual contexts. Although the analysis does not reflect Figure 1 completely, it should be unbiased because effects from the institutional, community, and school contexts operate in large part by influencing class conditions. The analysis will say little about the determinants of class conditions and instruction, but it is intended to include the most important predictors of achievement.

The data come from the Second International Mathematics Study (SIMS), conducted by the International Association for the Evaluation of Educational Achievement (known as the IEA). The SIMS data were collected from 22 countries in 1981-82. I have used the United States eighth grade sample, obtained from 316 classrooms in 161 public and private schools across the country. Virtually all students in these classes participated in the study, for a total of over 8,000 eighth graders. The data collectors identified the sample by selecting a random sample of districts and then randomly choosing schools within districts and classes within schools. This should have produced a nationally representative sample; however a low cooperation rate at the district level (about 50%) makes the representativeness of the sample somewhat questionable. Moreover, only 218 classes provided fall and spring achievement data as well as data from all the teacher questionnaires. My sample is restricted to these classes, which contained more than 5,000 students. Fortunately for our purposes, national representation is not essential. Further details on the sample and the data, as well as some descriptive findings, may be found in the report by Travers (1985).

Measures of Instruction and Achievement

The IEA study developed an innovative method of assessing content coverage. A team of experts, with consultation from teachers, identified the universe of content likely to be found in eighth grade mathematics classes. From this content they assembled a test on five subareas: Fractions, Algebra, Geometry, Measurement, and Ratio/Proportion/Percent. In addition to testing students in both the fall and spring, they presented the test to teachers and asked them to indicate whether the items had been covered during the year. If they had not been covered, teachers noted whether they had been covered previously, would be covered later, or were not in the curriculum. Thus the investigators measured content coverage by asking teachers to reveal how much they had taught to students in areas that represented the full range of the eighth grade mathematics curriculum.

How well does this procedure satisfy the criteria I noted for measuring content coverage? Investigators made great effort to ensure that the test, and thus the measure of coverage, fairly represented the material taught in eighth grade across the country (Travers, 1985). Obviously the measure of coverage is closely tied to the test.

Despite these strengths, this indicator is limited in one important way: each test item, and thus each "point" of content coverage, is not equally difficult. Initially high-achieving classes may spend more time covering fewer, more difficult items while low-achieving classes cover a greater number of easier items. Indeed, the correlation between class mean achievement and content coverage is -.14. This may give the appearance that low-achieving classes are catching up, when in fact the high-achieving classes are moving on to more difficult material. In interpreting the results we will need to bear this issue in mind.

I have used the pre-test and post-test "core items," which consist of eight items on each of the five areas for a total of forty items. I did not use the "rotated forms"--a larger set of items from which students took varying items--that were also given in the post-test. I have summed across the forty items for single scores of **Prior Achievement, Content Coverage,** and **Achievement.**

I used four measures of instructional time, take from teacher reports. **Total Weekly Time** was computed as the product of the number of math periods per week and the average length of the math periods. Teachers also reported the amount of time used in a typical week for explaining new material, reviewing old material, and maintaining classroom order (**Weekly Explanation Time, Weekly Review Time,** and **Weekly Discipline Time**). In the absence of observational corroboration, the reliability of these indicators is not known. No data were available on student engagement levels.

Classroom Context Variables

A number of class-level variables are expected to have indirect effects on achievement that operate by influencing instruction. These include **Class Size, Class Mean Achievement** on the pre-test, and three socio-demographic variables: **Class Percent Black, Class Percent Hispanic,** and **Class Mean Parental Education.** I also included a measure of years of **Teaching Experience** for each teacher.

The teacher questionnaires provided information on within-school curriculum differentiation. Teachers were asked to describe the main subject matter of their classes as "Remedial," "Typical," or "Enriched." Investigators also identified a subset of the enriched classes as "Algebra" classes, a more advanced curriculum for eighth graders. These indicators of curricular differences reflect two aspects of within-school stratification. First, they presumably describe differences in the actual curriculum to which students were exposed. To the extent that they do, the measure of content coverage should account for their effects on achievement. But these labels also signify positions in a social hierarchy within the school. By influencing students' expectations, self-concepts, and motivation, these categories may influence achievement independently of instructional differences.

Individual Variables

Besides prior achievement, several indicators of student characteristics were reported by students and included in the analyses. Socioeconomic status is indicated by Father's and Mother's Education, coded from one to four as having completed very little or no schooling, elementary or junior high school, high school, or post-high school. I used dummy variables to indicate race (1=Black), ethnicity (1=Hispanic), and gender (1=Female). I used two indicators of student effort: the typical weekly number of hours spent on math Homework, and the rating on a scale of strongly disagree to strongly agree on the statement, "I will work a long time in order to understand a new idea in mathematics" (Willingness to Work Hard).

Results

I used ordinary least squares regression to examine the effects of instruction and its classroom and individual contexts on achievement. I estimated a series of models, beginning with controls for student background variables, adding the influences of classroom variables and instruction, and concluding with the indicators of student effort. These models reveal not only the effect of each variable on achievement, but the importance of subsequent variables for mediating the effects of prior influences. For example, as I argued earlier, I expect class context effects to be largely explained by the effects of instruction.

Listwise deletion of missing values reduced the sample to 3995 students, just under seventy percent of the total of 5796. As a check, I also estimated the models using pairwise deletion, and found no meaningful differences in the results.

Effects of Background and Classroom Context

Table 1 displays the results. The first two columns reveal the importance of class-level variables. Whereas model 1 shows large effects of individual background characteristics, each of these effects is significantly reduced when controls for class composition--class size, mean achievement, percent black, percent Hispanic, and average parental education--are included in model 2. The coefficient for fall achievement, for example, declines from .894 to .743. While this effect is still very large--students scored three quarters of a point higher on the post-test for every additional point on the pre-test--it shows that nearly twenty percent of the total impact is associated with classroom classes. Most noticeably, students in classes with higher average pre-test scores achieved more, even with their own individual scores taken into account.

Table 1 about here.

Other individual-level coefficients decline even more in column 2. The effects for father's education, mother's education, and Hispanic ethnicity `e close to zero, and the coefficients for girls and blacks drop by about one third. At the same time, class size, percent Hispanic, and average parental education, along with mean achievement, all exert significant effects on achievement. These results indicate that a substantial portion of the variation in achievement lies between classes. This finding was expected, and it is consistent with earlier revelations of class-level effects by authors such as Summers and Wolfe (1974; 1977), Brown and Saks (1975), and Murnane (1975). Based this paper's argument, we car further expect these class composition effects to be largely explained by other classroom variables and especially by differences in instruction.

These expectations are borne out in part. The effect of class mean achievement drops by about one fifth when instruction is taken into account (columns 3a - 3b). A more dramatic change occurs for teacher experience (introduced in column 2c), whose influence disappears when instruction is controlled. Aoparently, more experienced teachers make better use of time and cover more curricular content.

The advantage held by high-achieving classes can be at least partially explained by these processes as well.

Model 2b introduces the curricular designations. It reveals three main findings:

1) The coefficient for the effect of class percent Hispanic drops by almost half to insignificance, and the effect for average parental education also drops substantially. It appears that class composition effects operate in part through curriculum differentiation: low-SES and minority students are more likely to be concentrated in low-status classes, which tend to produce low achievement. Surprisingly, the effect of class mean achievement does not exhibit a comparable decline.

2) The negative effect of class size almost doubles from column 2a to 2b. Curriculum differentiation appears to suppress part of the class size effect, probably because remedial classes tend to be smaller (r = -.16). This finding may indicate that although students in remedial classes score lower than others, their scores are not as low as they would be if all classes were of equal size.

3) As might be expected, student achievement is lower in remedial classes and higher in enriched classes than in classes described as typical (the omitted category). Subsequent equations do not account well for these differences. The enriched-class advantage declines by less than ten percent when variables for instruction and effort are introduced (columns 3a - 4). The remedial-class deficit grows when time is taken into account (model 3a), but declines when content coverage is controlled (3b). These results suggest that remedial-class teachers make better use of time--apparently spending more time on review activities (r = .12)--

but cover less material ($r = -.19$). Still, these fluctuations are small relative to the total size of the remedial-class effect.

To the extent that the class designations reflect real curricular differences, I expected the indicators of instruction, especially coverage, to account for their effects. To the extent that they indicate differences in symbolic status, I expected student effort to account for at least part of their impact. But in these data, available indicators of instruction play a minimal role in explaining the effects of curriculum differentiation, and effort plays no part at all.

Membership in an algebra class made essentially no difference for student achievement. This finding may be surprising, for the algebra classes bear the highest status; yet their coverage was the lowest of any category ($r = -.57$). The result probably reflects a problem I mentioned earlier: the algebra classes may have covered fewer, more difficult items than other classes. Moreover, the test may not have contained enough algebra items to reveal the true growth of students in these classes.

The Effects of Instruction and Student Effort

Instructional variables enter the analysis in columns 3a and 3b. Preliminary work indicated the possible presence of nonlinear effects of total weekly time, suggested by negative effects at high values of weekly time. To consider this possibility, I included a quadratic term for this variable. As column 3a shows, though, neither the linear nor the quadratic term has a significant effect on achievement. Weekly explanation time is also inconsequential, but time spent reviewing old material raises achievement, while time spent maintaining order lowers it. Apparently it is not the mere availability of time, but how it is used, that matters for student achievement.

Although these effects are statistically significant, they are practically quite small. The coefficient for review time ($\underline{b}$ = .007) indicates that an increase of about 140 minutes per week, or almost 30 minutes daily, would be needed to raise achievement by a single point! The effect of discipline time ($\underline{b}$ = -.019) is perhaps more meaningful: each additional 50 minutes weekly, or 10 minutes per day, reduces achievement by one point, all else being equal. As I remarked earlier, the lack of observational data may well hamper our ability to generate information that is precise enough to detect the true effects of time usage.

Like the time coefficients, the effects of content coverage in these data are statistically significant but substantively small. The coefficient of $\underline{b}$ = .046 means that a teacher would need to cover about 20 more items--half of those available--to raise achievement one point. As I noted for the algebra classes, the data may contain a ceiling on coverage in certain areas. If there are too few items to show true achievement growth for some classes, then the coverage scores would be restricted as well.

Student-reported time spent on homework reveals no effect on achievement, in contrast to the findings of other studies (e.g., Keith, 1985). However student effort, as indicated by self-reported willingness to work hard, does add to achievement. The only prior variable affected by the inclusion of effort is gender: girls achieve more than boys in part because they are more willing to exert effort for math. The gender effect has declined steadily across the seven equations, but remains significant in the final column. Race is the only other background variable that remains significant after all other conditions have been controlled; the others became non-significant as soon as the class-level variables were introduced.

Discussion

The large between-class differences in achievement constitute the most salient result of the foregoing analysis. As predicted, an important segment of variation in achievement can be attributed to within-school variation in academic circumstances. But contrary to my expectations, the indicators of instruction did not satisfactorily explain the class-level differences. Time usage and content coverage showed significant but relatively small effects on achievement. Thus the analysis essentially confirms the findings of Brown and Saks (1975), Murnane (1975), and Summers and Wolfe (1977) on within-school effects on achievement, but fails to move beyond their work. The present analysis does not show the great importance of instructional processes as found by Barr and Dreeben (1983), Rowan and Miracle (1983), and Gamoran (1986).

Why does instruction appear less important (though still a significant factor) in the present study? I have already commented on two possible weakness of the instructional measures: the absence of observational data on time usage; and the possible ceiling on content coverage as a consequence of its derivation from test items. Yet a third limitation may be even more critical: it may be that what matters is not the quantity of time and coverage, but the quality of instruction. We may need to examine not just what is covered, but how it is taught. For example, teachers may have varied in the emphasis they gave to certain items on the coverage scale. One teacher may have introduced thirty items rapidly, while another went into great depth on ten of them, and the second teacher may have produced equally high achievement.

For this reason we need to develop indicators of instructional quality. These measures must be more than simply a listing of activities, as has been found in previous research (e.g., Brophy and Evertson, 1974). Instead, they require a conceptual formulation aimed at revealing what instruction is and how it works. Firm conceptualization will enable the development of instructional indicators that might account for the largely unexplained class-level effects in my analysis. Such indicators are likely to be stronger predictors of achievement than the instructional variables used here.

Despite the stability of individual performance over the course of eighth grade, the SIMS data clearly show that schooling has an impact on achievement growth. I discovered noteworthy between-class effects on spring achievement, controlling for fall achievement. Indeed, these classroom effects accounted for a substantial portion of the variation between individuals. Available measures of instruction did not account for the class-level differences. Still, I maintain that better conceptualization and measurement of instruction would help to explain how these class effects came about.

REFERENCES

Alexander, Karl L., and Martha A. Cook. 1982. "Curricula and Coursework: A Surprise Ending to a Familiar Story." American Sociological Review 47:626-640.

Alexander, Karl L., and Aaron M. Pallas. 1984. "Curriculum Reform and School Performance: An Evaluation of the 'New Basics.'" American Journal of Education 92:391-420.

Alexander, Karl L., Gary Natriello, and Aaron M. Pallas. 1985. "For Whom the School Bell Tolls: The Impact of Dropping Out on Cognitive Performance." American Sociological Review 50:409-420.

Averch, H., S. J. Carroll, T. S. Donaldson, H. J. Kiesling, and J. Pincus. 1972. How Effective is Schooling? Santa Monica, CA: Rand Corporation.

Barr, A. S. 1929. Characteristic Differences of Good and Poor Teachers. Bloomington, IL: Public School Publishing Co.

_____. 1948. "The Measurement and Prediction of Teaching Efficiency." Journal of Experimental Education 16:203-283.

Barr, Rebecca. 1973-74. "Instructional Pace Differences and Their Effect on Reading Acquisition." Reading Research Quarterly 9:526-554.

_____. 1983. "Content Coverage in Classrooms." In T. Husen and N. Postlethwaite (eds.), International Encyclopedia of Education. Oxford: Pergamon.

Barr, Rebecca, and Robert Dreeben. 1977. Instruction in Classrooms. Pp. 89-162 in Review of Research in Education, Vol. 5, edited by Lee S. Shulman. Itasca, IL: Peacock.

_____. 1983. How Schools Work. Chicago: University of Chicago Press.

Bidwell, Charles E., and John D. Kasarda. 1980. "Conceptualizing and Measuring the Effects of School and Schooling." American Journal of Fducation 88:401-430.

Bloc~, Benjamin S. 1976. Human Characteristics and School Learning. New York: McGraw-Hill.

Brophy, J. E., and Evertson, C. M. 1974. Pocess-Product Correlations in the Texas Teacher Evaluation Study. Austin, TX: University of Texas Research and Development Center for Teacher Education, report no. 74-4.

Brown, Byron W., and Daniel H. Saks. 1975. "The Production and Distribution of Cognitive Skills within Classrooms. Journal of Political Economy 83:571-593.

Carroll, John B. 1963. "A Model of School Learning." Teachers College Record 64:723-733.

Coleman, J., E. Campbell, C. Hobson, J. McPartland, A. Mood, F. Weinfield, F., and R. York. 1966. Equality of Educational Opportunity. Washington, DC: U.S. Government Printing Office.

Coleman, J. S., and T. Hoffer. 1987. Public and Private High Schools: The Impact of Communities. New York: Basic Books 1987.

Cookson, Peter W., Jr., and Caroline H. Persell. 1985. Preparing for Power. New York: Basic Books.

Dahllof, Urban. 1971. Ability Grouping, Content Validity, and Curriculum Process Analysis. New York: Teachers College Press.

Denham, C., and A. Lieberman, (eds.). 1980. Time to Learn. Washington, D.C.: National Institute of Education.

Doyle, Walter. 1977. In Lee S. Shulman, (ed.), Review of Research in Education, Vol. 5: 164-188.

Dreeben, Robert, and Rebecca Barr. Forthcoming. "An Organizational Analysis of Curriculum and Instruction." In Maureen T. Hallinan (ed.), The Social Organization of Schools: New Conceptualizations of the Learning Process. New York: Plenum Publishing Co.

Dreeben, Robert, and Adam Gamoran. 1986. "Race, Instruction, and Learning." American Sociological Review 51:660-669.

Dunkin, Michael, and Bruce J. Biddle. 1974. The Study of Teaching. New York: Holt, Rinehart, and Winston.

Fisher, Charles W., and David C. Berliner. 1985. Perspectives on Instructional Time. New York: Longman.

Flanders, Ned A. 1970. Analyzing Teaching Behavior. Reading, MA: Addison-Wesley.

Gamoran, Adam. 1985. "Organizational and Institutional Determinants of Instructional Pacing." Paper presented at the International Seminar of the Research Committee on Sociology of Education, International Sociological Association, Tel Aviv, Israel.

_____. 1986. 'Instructional and Institutional Effects of Ability Grouping." Sociology of Education 59:185-198.

_____. 1987. "The Stratification of High School Learning Opportunities." Sociology of Education, July.

Gamoran, Adam, and Robert Dreeben. 1986. "Coupling and Control in Educational Organizations." Administrative Science Quarterly 31:612-632.

Harnischfeger, Annagret, and David E. Wiley. 1981. "Origins of Active Learning Time." Studies of Educative Processes, No.18, Northwestern University.

Hauser, Robert M. 1969. "Schools and the Stratification Process." American Journal of Sociology 74:587-611.

Heathers, Glen. 1969. "Grouping." In R. L. Ebel (ed.), Encyclopedia of Educational Research: 559-570. Fourth Edition. New York: Macmillan.

Heyns, Barbara. 1978. Summer Learning and the Effects of Schooling. New York: Academic.

_____. 1986. "Educational Effects: Issues in Conceptualization and Measurement." Pp. 305-340 in John Richardson (ed.), Handbook of Theory and Research for the Sociology of Education. Westport, CT: Greenwood.

Hollingshead, A. B. 1949. Elmtown's Youth. New York: Wiley.

Jencks, C. L., M. Smith, H. Acland, M. J. Bane, D. K. Cohen, H. Gintis, B. Heyns, and S. Michaelson. 1972. Inequality: A Reassessment of the Effects of Family and Schooling in America. New York: Basic Books.

Karweit, Nancy. 1983. Time on Task: A Research Review. Baltimore: Center for the Social Organization of Schools, report no. 332.

Karweit, Nancy, and Robert Slavin. 1981. "Measurement and Modeling Choices in Studies of Time and Learning." American Educational Research Journal 18:157-172.

Kilgore, Sally B. 1986. "Schooling Effects: Reconceptualizing How Sociologists Look at Schools." Paper presented to the National Center on Effective Secondary Schools, Madison, Wisconsin.

Lavin, David. 1965. The Prediction of Academic Performance. New York: Sage Foundation.

Mackenzie, D. E. 1983. "Research for School Improvement: An Appraisal of Some Recent Trends." Educational Researcher 12:5-16.

Meyer, John W. 1970. "High School Effects on College Intentions." American Journal of Sociology 76:59-70.

_____. 1977. "The Effects of Education as an Institution." American Journal of Sociology 83:55-77.

_____. 1980. "Levels of the Educational System and Schooling Effects." In C. E. Bidwell and D. M. Windham (eds.), The Analysis of Educational Productivity, vol. 2: Issues in Macroanalysis: 15-63. Cambridge, MA: Ballinger.

Murnane, Richard J. 1975. The Impact of School Resources on the Learning of Inner City Children. Cambridge, MA: Ballinger.

Oakes, Jeannie. 1985. Keeping Track: How Schools Structure Inequality. New Haven: Yale University Press, 1985.

Parsons, Talcott. 1960. "Some ingredients of a general theory of formal organization." Pp. 59-96 in Structure and Process in Modern Societies. Glencoe, IL: Free Press.

Rowan, Brian. 1985. "Shamanistic Rituals in Effective Schools." Issues in Education 2.

Rowan, Brian, and Andrew W. Miracle, Jr. 1983. "Systems of Ability Grouping and the Stratification of Achievement in Elementary Schools." Sociology of Education 56:133-144.

Rubinson, Richard. 1986. "Class Formation, Politics, and Institutions: Schooling in the United States." American Journal of Sociology 92:519-548.

Ryans, David G. 1960. Characteristics of Teachers. Washington, DC: American Counsel on education.

Sørensen, Aage B., and Maureen T. Hallinan. 1977. "A Reconceptualization of School Effects. Sociology of Education 50:273-289.

_____. 1986. "Effects of Ability Grouping on Growth in Academic Achievement." American Educational Research Journal 23:519-542.

Summers, Anita A., and Barbara L. Wolfe. 1974. Equality of Educational Opportunity Quantified: A Production Function Approach. Philadelphia: Federal Reserve Bank of Philadelphia.

_____. 1977. "Do Schools Make a Difference?" American Economic Review 67:639-652.

Thompson, James D. 1967. Organizations in Action. New York: McGraw-Hill.

Travers, Kenneth J. 1985. Second International Mathematics Summary Report for the United States. Urbana, Illinois.

Waller, Willard W. 1932. The Sociology of Teaching. New York: Russell and Russell.

Weick, Karl E. 1976. "Educational Organizations as Loosely Coupled Systems." Administrative Science Quarterly 21:1-19.

Wiley, David E., and Annagret Harnischfeger. 1974. "Explosion of a Myth: Quantity of Schooling and Exposure to Instruction, Major Educational Vehicles." Educational Researcher 3:7-12.

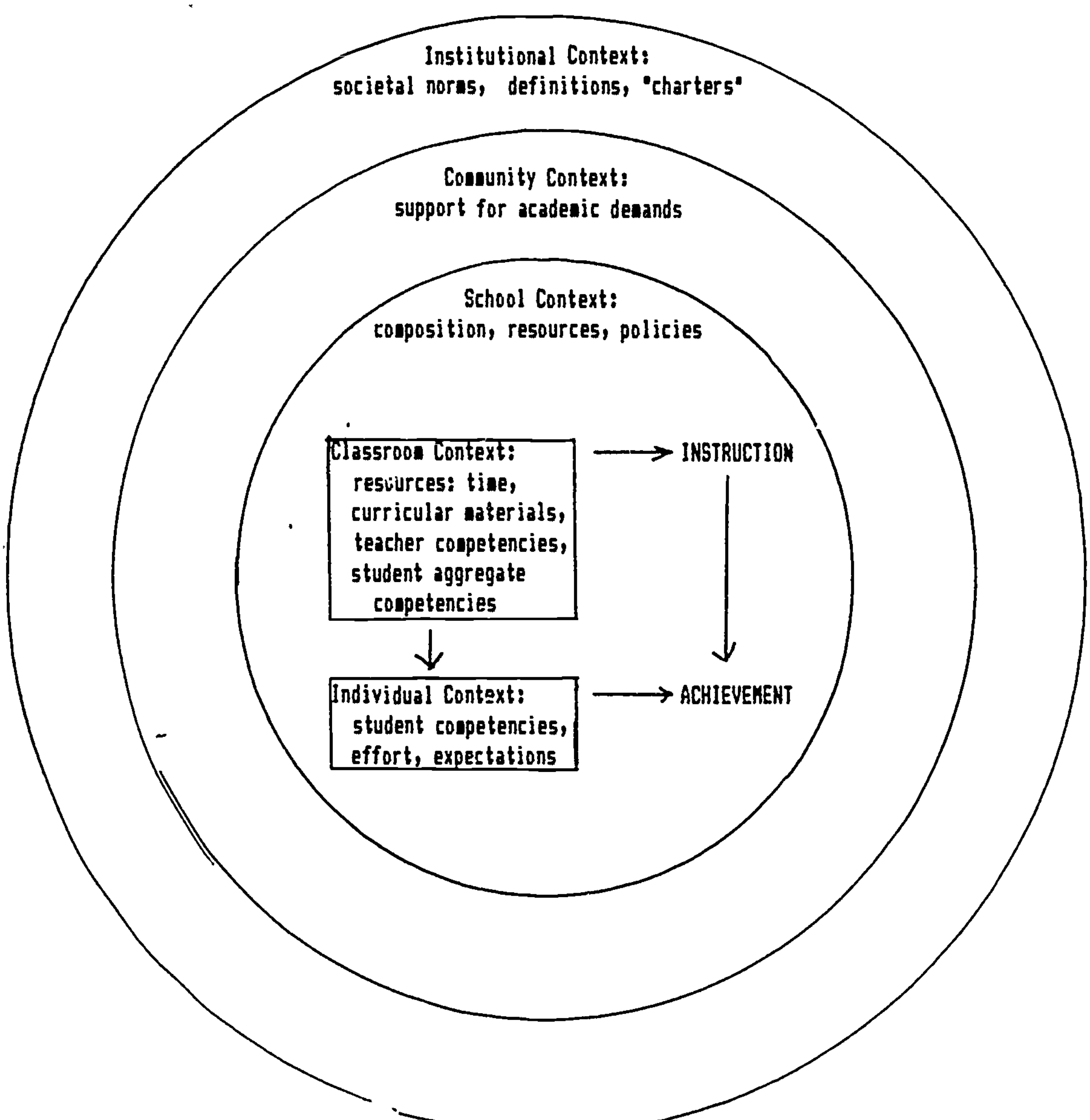

Figure 1. The schooling process: instruction and its social context.

Table 1. Classroom and instructional effects on achievement in eighth grade mathematics. Unstandardized regression coefficients (standard errors); n=3995.

Dependent Variable - Spring Achievement

Independent Variable	Model						
	Student Background	Classroom Context			Instruction		Student Effort
	(1)	(2a)	(2b)	(2c)	(3a)	(3b)	(4)
Female	.702***	.464**	.406*	.387*	.369*	.360*	.330*
	(.174)	(.171)	(.167)	(.167)	(.166)	(.165)	(.166)
Black	-1.612***	-1.110**	-1.025*	-1.013*	-1.023*	-1.020*	-1.033*
	(.309)	(.419)	(.409)	(.409)	(.406)	(.406)	(.406)
Hispanic	-1.176**	-.249	-.243	-.254	-.271	-.270	-.268
	(.407)	(.460)	(.449)	(.448)	(.446)	(.445)	(.445)
Father's Educ.	.500**	.231	.257	.260	.269	.287	.286
	(.152)	(.152)	(.149)	(.149)	(.148)	(.149)	(.148)
Mother's Educ.	.317	.030	-.006	-.012	-.012	-.034	-.034
	(.164)	(.163)	(.160)	(.160)	(.159)	(.159)	(.156)
Fall Achiev.	.894***	.743***	.742***	.741***	.741***	.741***	.742***
	(.012)	(.017)	(.016)	(.016)	(.016)	(.016)	(.016)
Class Size		-.028*	-.053***	-.056***	-.051***	-.051***	-.052***
		(.012)	(.012)	(.012)	(.012)	(.012)	(.012)
Class Mean Achievement		.230***	.239***	.231***	.205***	.193***	.192***
		(.026)	(.030)	(.030)	(.030)	(.030)	(.030)
Class % Black		-.169	.719	.803	1.069	.887	.866
		(.614)	(.607)	(.607)	(.614)	(.616)	(.617)
Class % Hispanic		-2.277*	-1.302	-1.083	-1.265	-1.775	-1.732
		(.946)	(.931)	(.932)	(.933)	(.945)	(.945)
Class Mean Parents' Educ.		1.812***	1.042*	1.151**	1.102*	1.040*	1.065*
		(.437)	(.431)	(.431)	(.431)	(.431)	(.431)
Remedial Curriculum			-2.723***	-2.789***	-3.029***	-2.720***	-2.744***
			(.343)	(.349)	(.352)	(.365)	(.365)
Enriched Curriculum			1.997***	1.907***	1.653***	1.864***	1.856***
			(.220)	(.221)	(.222)	(.222)	(.222)
Algebra Curriculum			-.742*	-.671	-.401	.332	.337
			(.343)	(.343)	(.345)	(.414)	(.417)
Teacher Experience				.034***	.019	.012	.012
				(.010)	(.010)	(.010)	(.010)
Total Weekly Time					-.000	.004	.003
					(.022)	(.022)	(.022)
(Total Weekly Time)^2					-.000	-.000	-.000
					(.000)	(.000)	(.000)
Weekly Explanation Time					.001	.001	.001
					(.002)	(.002)	(.002)
Weekly Review Time					.007**	.007**	.008**
					(.002)	(.002)	(.002)
Weekly Discipline Time					-.019***	-.019***	-.019***
					(.005)	(.005)	(.005)
Content Coverage						.046**	.046**
						(.014)	(.015)
Homework Time							-.019
							(.042)
Willingness to Work Hard							.184*
							(.081)
R^2	.645	.662	.678	.679	.684	.684	.685

* p < .05 ** p < .01 *** p < .001

Table A1. Means and standard deviations of variables (n=3995)

Variable	Mean	Standard Deviation
Spring Achievement (40-point test)	20.137	9.173
Fall Achievement (same test)	15.887	7.877
Female	.528	.499
Black	.094	.292
Hispanic	.052	.221
Father's Education (4 categories)	3.434	.684
Mother's Education (4 categories)	3.388	.633
Class Size (number of students)	27.159	6.960
Class Mean Achievement	15.634	5.967
Class % Black	.097	.207
Class % Hispanic	.051	.114
Class Mean Parents' Education	3.403	.291
Remedial Curriculum	.078	.268
Typical Curriculum	.571	.400
Enriched Curriculum	.214	.410
Algebra Curriculum	.137	.344
Teacher Experience (years)	14.336	8.581
Total Weekly Time (minutes)	238.761	32.755
Weekly Explanation Time (minutes)	98.097	50.226
Weekly Review Time (minutes)	60.370	35.136
Weekly Discipline Time (minutes)	16.837	17.283
Content Coverage (40 test items)	27.312	7.665
Homework Time (hours each week)	2.653	1.017
Willingness to Work Hard (scale of 1 to 5)	3.252	1.107